The Engineering News.

A Journal of Practical Science and Public Improvements

PUBLISHED MONTHLY.

APRIL 15th, 1875.

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having sufficient capacity, they would be very expensive. both on account of the labor and material required in their construction, and the ground they would occupy.

3d, There would be danger to the health of the city during the prevalence of winds from the quarter in which the sewerage might be used as a manure, especially, if only a few miles distant, and spread over a wide surface.

Should the time ever arrive when the value of the sewerage as a manure would be so great as to call for a system of drainage, permitting it to be saved for this purpose, the sewers now proposed would by no means be useless, but would be exceedingly valuable in providing for the surface water, and thus allowing the most economical construction possible, if a system of small sewers to drain simply what would be valuable as a manure, together with as much surface or other water as might from time to time be necessary for flushing purposes. It is said by very respectable authority, (see the article "Drainage" in the Encyclopedia Brittanica) that to drain a city perfectly, a system of sewers should be constructed for the surface water, separate from that provided for other kinds of drainage.

Without, however, constructing a new system of sewers, the contents of those now proposed, might easily be collected by intercepting sewers, parallel or nearly so, with the river and its branches, and then pumped into such other sewers or reservoirs as might be deemed most advisable,

With regard to the fourth plan, or draining into the proposed steamboat canal, which would divert a large and constantly flowing stream from Lake Michigan into the Illinois River, it is too remote a contingency to be relied upon for present purposes; besides, the cost of it, or any other similar channel n that direction, sufficient to drain off the sewage of the city, would be not only far more than the present sewerage law provides for, but more than would be necessary to construct sewers for five times the present population,

Should the proposed steamboat canal ever be made for commercial purposes, the plan now recommended would be about as well adapted to such a state of things as it is to the present, making it necessary to abandon only the proposed method of supplying the South Branch with fresh water from the Lake, and to pump up from the new canal, or draw from the DesPlaines directly, flushing water for the West District, instead of obtaining it from the present canal at Bridgeport as herein recommended.

[TO BE CONTINUED.]

Where to Advertise.

Since our last issue we have received the renewals of very nearly all of our old subscribers, and with them the most flatterings commendations of our journal. Our subscription list has also been very considerably increased by numerous clubs of new subscribers sent us from all parts of the country. We are very grateful for these recognitions of our enterprise and they stimulate us to renewed efforts to do still better in the future. Our efforts thus far have been mainly directed to establishing a character for our paper, and introducing it to the profession and the general public. We think we have accomplished a good deal, and in the present number of THE ENGINEERING NEWS we give more information of genuine practical value to the profession we represent, and to the general public, than any other scientific periodical in the country, while the price is so low that many of our friends were justly marvel how we can afford it.

Our journal has been introduced into every county, and into every city or town of 3000 or more inhabitants in the Union, and now, every State and territory is represented on our mail list. Among our subscribers are the City Engineers of most of the principal cities, from many of whom we have received the most gratifying communications; railway, waterworks, and other engineers are largely represented, and we do not doubt there are more surveyors on our list than on that of any other single journal in this country.

The value of class journals as advertising media, are now generally recognized by business men. If locomotives are for sale they are advertised in the *Railroad Gazette*; if a new patent is to be introduced it is duly illustrated in the columns of the *Scientific American*, the *American Artizan*, or the *Manufacturer and Builder;* mowing machines and Berkshire pigs are advertised in the *Western Rural* or the *Prairie Farmer*; trotting matches and prize fights in *Wilkes' Spirit of the Times*, and so on. These, and other similar journals, depend for support on the patronage of certain classes of advertisers; and the advertisers use these journals *because it pays* to do so.

The ENGINEERING NEWS is taking its place among the journals of this country. Its publisher has not started it as a speculation, but as a permanent investment, and one that must ere long take first rank with the best periodicals in the Union. We claim then the support of the profession. One charge against it, constantly urged by business men, is that surveyors and engineers control no trade that is worth looking after. We wish to prove the contrary, and we hope our friends will get the prices and terms of the advertising patrons of this journal before looking elsewhere. We know most of these personally, and we feel assured that it will pay to trade with them. Make this journal your medium for advertising your wants, or what you have to sell, and get your friends to do so. Give it a hearty support, and you will soon see how we will reciprocate. We want to see a recognized professional influence, and the sooner an organized effort to concentrate our forces is made, the sooner will our influence be felt.

Civil Engineers' Club of the Northwest.

The regular April meeting of the Club was held on Tuesday evening, the 6th inst. at the Club rooms, 145 Clark street, with sixteen members present, and President Chesbrough in the chair. After the minutes of the last meeting had been read and approved, Prof. Lyman E. Cooley, of the N. W. University, Evanston Ills., was proposed for membership.

In the absence of the member who was to have read a paper, the chairman read the following notes by Capt. Falcon, a well-known American diver, of his experience. Before reading them the Chair stated that up to within a comparatively recent date it had been generally believed that the effects of waves were not felt at a greater distance than from 13 to 14 feet beneath the surface of the water. Within the last ten years, however, it had been discovered that such was not the case, but that on the contrary large bodies had been known to be moved at the bottom of the sea, which motion could not but be attributed to the action of the waves.

Capt. Falcon was present and gave some interesting information relativeto his experience as a diver, especially in deep water.

O. B. Green gave notice that at the regular meeting in May, he would present an amendment to the present By-Law, requiring the annual meeting of the society to be held on the first Tuesday of June. This is done to accomodate such members as may be d sposed to attend the annual meeting of the American Society of Civil Engineers whose annual meeting is held in the first week in June.

Mr. Billings, engaged on the harbour survey, exhibited a Transit from the manufactory of Messrs. Nickel & Strassberger. The instrument was a beautiful one and had several very valuable improvements which the manufacturers lately introduced, and which Mr. Billings exhibited to advantage.

The meeting then adjourned.

A survey is going on to find the difference of level between the bed of Red River above the raft and Trinity River of Texas, near Gainsville, not far from the source. The object is to report upon the feasibility of turning the waters of the Red into the Trinity, with a view of improving the navigation ot the later, and reclaiming the valley of the former from annual inundations by floods.

Astronomical Notes.

PREPARED FOR THE ENGINEERING NEWS BY S. W. BURNHAM, F. R. A. S.

A meeting of the Chicago Astronomical Society was held April 2d, to take action upon the proposed repairs of the Observatory, and the reorganization of the society. Through the untiring efforts of Mr. E. Colbert, of the *Tribune*, the sum of $5,000 has been subscribed for putting the dome in order. Mr. Colbert reported a list of the names of the subscribers, with the amounts, the larger portion being $100 each, entitling the subscriber to a life membership in the Society; and stated that the amount was nearly all collected; and as the plans had been approved by Prof. Safford, the preparation of materials was already at hand. Authority was given to Mr. Colbert, and Mr. W. H. Wells, one of the original founders of the Society, to disburse the money as the work demanded. Prof. Safford, at the request of the members, gave an interesting account of the astronomical work completed and in progress, when interrupted by the great fire. It will be remembered that Prof. Safford was the only American Astronomer who had the honor of being assigned a section of the work on the great Catalogue of all the Stars in the Northern Heavens, to be published under the auspices of the celebrated German Astronomical Society. As none but the leading observatories of the world participate in this great work, it is a distinguished though well deserved tribute to his reputation as a practical and theoretical astronomer. Subsequently the Harvard College Observatory undertook another portion of the work, the remainder being distributed among eight or ten of the principal institutions in England and on the Continent. Up to the time of the fire the work here was being vigorously carried on, but from want of funds had to be suspended then, and very little has since been done. During the past three years Prof. Safford has been employed by the Government in doing astronomical work in connection with the survey of the boundary lines of several of the territories, determining longitudes, and reducing observations; and has also given a portion of his time to teaching and lecturing before some of the Eastern colleges. More recently he has been preparing a catalogue of stars for the War Department, which is now in press. The Society requested Prof. Safford to prepare a detailed report for publication, which he will do and probably submit at the next meeting. The Society then adjourned for two weeks, when the question of the reorganization upon a more popular basis will be considered.

Volume XL. of the MEMOIRS OF THE ROYAL ASTRONOMICAL SOCIETY, has just been published, comprising Sir John Herschel's General Catalogue of the approximate places of 10,300 Double Stars. Sir John Herschel left his manuscript of a work in an unfinished state, which he proposed to call a "General History of Double Stars," to the Astronomical Society. After his death the question of its publication was referred to a committee, who reported favorably, and the Rev. Mr. Main, and the Rev. M. Pritchard, were selected, several years ago, to prepare it for the press, and it has at last made its appearance. Instead of reducing the places of the stars to some epoch near the present time, and giving measures of angles and distances, magnitudes, and other necessary information, they have inserted the places of the stars for 1830, nine-tenths of them being merely copied from the original catalogues, without giving any other information whatever. In addition to this, while the catalogue purports to be complete, there are at least several hundred omissions, and many of them of the most important character. Many pairs are inserted twice from different sources, as though they were independent stars, when the most cursory examination should have made their identity apparent. A large number of errors in the lists of Struve, Herschel, and others, long ago corrected, have been passed by unnoticed; and a good many mistakes in precessions, some of them, perhaps, owing to the printer, stand undetected. As presented, this work is of little if any use to the double star observer, and certainly never would have been allowed to appear in its present shape had the illustrious Herschel lived to complete his projected work.

One of the most interesting of the close binary stars is μ^2 Bootis, discovered by Sir William Herschel, in 1872. The distance of the two stars never exceeds 1", and they have approached within less than 0".5 of each other. This pair has been measured by nearly all the well known observers, during the last sixty years. Struve, Secchi, Dawes, and Dembowski have given it special attention. A few years since Hind calculated its period from the observations up to that time, and made its value 314 years. Doberck, of the Markree Observatory (Ireland), has collected all the measures made down to 1872, and from a careful discussion of all the results, he makes the periodic time 290 years, a result not so discordant with the other, when the time covered by the observations, and the difficulty of the object, are taken into account. The angle between the stars has changed in a retrograde direction from 357°, when first measured by Herschel, to 150°, as found by Baron Dembowski in 1872. This binary is rendered more than usually interesting from a probable physical connection between it and a fourth magnitude star at a distance of about 108". Struve finds that these stars have a common proper motion, from which it may be inferred they are comparatively near each other, and all members of one grand system. The period of the wide pair would undoubtedly extend over thousands of years, and probably centuries will elapse before its duration can be even approximately determined.

In the March number of the NEWS mention was made of the recent discovery, by a Chicago observer, of a companion to β Leporis, much nearer than Herschel's small star noted at the Cape of Good Hope, at a distance of 70". Since the last issue, a letter from the well known double-star observer, Baron Dembowski, to whom the discovery was communicated, has been received, containing among other observations two sets of measures of this beautiful pair. The mean result for the angle is 267°.8, and distance 2".89. He calls the companion 11th magnitude, and notes it in one observation as "very difficult." Herschel failed to see it in a southern latitude, where the star is much more favorably situated, with a reflecting telescope of 18 inches aperture, and yet it was found with an object glass of only six inches in diameter, a fact at least tending to show the superiority of modern instruments.

During the year ending Feb'y 1st, 1875, eight new minor planets were discovered, four of them by Palisa, at Polo, and one each by Henry of the Paris Observatory, Perrotin at Toulouse, Dr. Peters at Clinton, and Prof. Watson, of Ann Arbor, at Pekin, China. Six new comets have been discovered in addition to the re-appearance of periodical visitors Two of these were found by Winnecke at Strasburg, and two by Borrelly at Marseilles, With the exception of the splendid comet of Coggia, they are all faint telescopic objects.

The figure of the second great 26-inch object glass has been completed by Alvan Clark & Sons, and they are now at work on the mounting. This telescope, which is a duplicate of the one at the naval observatory, is made for Mr. L. J. McCormick, of this City. It has not been announced where it will be erected, but the institution receiving it will be fortunate in possessing one of the finest and largest instruments in the world. The first discovery with it was made by Mr. Alvan G. Clark, using the object glass in a temporary tube, who dected the duplicity of the star τ Cygni. Baron Dembowski has recently measured this pair, making the distance 1".06, and the position angle 174°.8. He gives the magnitudes of the components as 4.5 and 7.5, the larger being light yellow, and the smaller light blue.

The gold medal of the Royal Astronomical Society has this year been awarded to Prof. D'Arrest, Director of the Observatory of Copenhagen, for his observations of Nebulæ and other astronomical work. D'Arrest commenced at the Leipzig Observatory, determining accurately the positions of some of Herschel's nebulæ, for the purpose of ascertaining their proper motion, and his observations of 236 of them were published in the Transactions of the Royal Saxon Society of Sciences, in 1856. These observations were made with a refractor of only 4½ French inches in aperture, with a double ring-micrometer. It is generally supposed that large instruments are necessary for such work, and yet D'Arrest states that a glass of that size is capable of showing nearly one thousand nebulæ, which is one-third of all that have been observed in this latitude with the most powerful telescopes. From a comparison of his places with those given by Herschel, he concludes that the probable amount of the annual relative motion of the nebulæ, with respect to the sidereal system is less than 0".4. Upon his appointment to the Directorship of the Copenhagen Observatory, he continued the measures with an aperture of nearly 11 inches, an instrument readily showing the faintest of the objects detected by Herschel with the 20-foot reflector. His great work published in 1867, contains 4,800 positions of 1942 different nebulæ. Of these 390 had not been previously observed, or their places had not been accurately determined. Herschel's General Catalogue describes 125 nebulæ discovered by D'Arrest. Among those who have contributed to the spectroscopic observations of the nebulæ, D'Arrest holds a prominent place.

Prof. Ormond Stone of the U. S. Naval Observatory has been elected the director of the Cincinnati Observatory. Prof. Stone is a native of this City, and was formerly assistant observer at the Dearborn Observatory. He is a fine observer, an excellent mathematician, and eminently qualified by education and experience to place the observatory under his charge in the list of institutions doing systematic and important work. The observatory has been moved

from the place it occupied in Mitchell's time, to a more advantageous locality, at a greater distance from the city. The equatorial is a fine Munich glass of 12-in. aperture, and at the time it was purchased had but one superior in the country, that of the Cambridge observatory.

Boundary Lines of States & Territories.

WRITTEN FOR THE ENGINEERING NEWS BY PROF. T. H. SAFFORD, DIRECTOR OF DEARBORN OBSERVATORY.

In most cases, the boundary lines used in this country, are parallels of latitude, or meridians of longitude; when they are so, their proper running and marking requires rather delicate processes of astronomy, as well as careful surveying.

A meridian is a due north and south line, as surveyors understand it. It can be run with some accuracy with the solar compass; but better with a nice transit instrument, well made. The ordinary theodolite or surveyor's transit, with a vertical circle, is not quite accurate enough; the instrument to be used should have a telescope of 1¼ inches aperture, magnifying about 20 times, with a diagonal eye-piece; some contrivance for lighting the field at night; a striding level for the axis; and be thoroughly well made.

In order to run a meridian line, observations upon the Pole star, and for time should be taken every clear night. The observer should have a good watch regulated, if possible, to run nearly on sidereal time—that is to gain about 3 minutes and 56 seconds daily, or one day in a year, on ordinary time. He should have a nautical almanac, and a table of the azimuth of the pole-star for different sidereal times, and the different latitudes of his line, and be thoroughly skilled in time observations.

He will begin by setting up his instrument (at his starting point), so that its vertical axis shall be truly vertical, when its horizontal axis should be horizontal at all pointings of the telescope. He should then adjust the collimation and turn the instrument as nearly into the meridian as he can guess, and observe the time of transit of two stars near the zenith—the one north and the other south—across the vertical wire of his instrument. The sidereal-watch-time of these stars' transits will be compared with their right ascension, as given in the nautical almanac; this is the true sidereal time of their transit, and the differences will show the same error of the watch, provided the instrument is really in the meridian. If the differences are not the same the instrument is not really in the meridian; but if the two stars are near to the zenith, the watch-errors will agree well enough for the next operation, which is to point at Polaris, note the time, and read the horizontal circle. The watch-time corrected for watch-error gives the true sidereal time, an error of a minute or so in this is HERE of no consequence), and this gives by the table the azimuth of Polaris quite nearly; which added to or substracted from the circle reading, gives the circle reading for the true meridian at least within 1′. The instrument can now be brought very near the meridian, and the watch-error got again by two stars, much more closely; and from this the instrument brought as exactly into the true meridian as the skill of the observer will allow. The meridian ought to be twice fixed, the second time after a half-turn of the whole upper part of the transit around the vertical axis, to show and get rid of the effect of the error of collimation. A mark should be fixed that night, pretty far off, so that the focal adjustment need not be changed, and the line run by it the next day. Even if the ground is very rough, it will be necessary to avoid taking very short sights; in these cases it might be preferable for a short distance to use the best solar compass, which runs its own meridian by the sun.

After the halt for the night, if the weather is clear, the meridian should be fixed again by the pole-star; the watch ought to run well enough to make it unnecessary to observe more than two stars for time. In running the line, the instrument should be turned half round on its vertical axis for alternate stations; so that if it has any small outstanding error of collimation it will be eliminated.

A parallel of latitude is not what surveyors call a due east and west line, strictly speaking; the latter is a great circle, but the parallel a small circle. The two circles, however, are tangent to each other; and to run the parallel offsets are necessary at the end of every line which was started as a due east and west line. The calculation of these offsets can be made roughly by spherical trigonometry; and they should be tabulated for the parallel in hand, and for different distances, before starting. The posts on the parallel have always to be placed north of the stakes on the due east and west line.

The U. S. Land office requires every parallel to be tested by observed latitudes, about every 50 or 60 miles; and these can be well determined only by pretty large astronomical instruments. The lightest instrument for the purpose is the "astronomical transit," used in the prime vertical. It has the advantage of giving the direction of the line at each latitude station more accurately than even the best surveyor's transit; and as the intermediate lines are but 50 or 60 miles long, they can be run with a less expensive instrument. This should, however, be fitted up to observe the polar star for the direction of the meridian. The astronomical transit should be firmly set up on a strong and well seasoned post; perhaps iron stakes, large enough, will be better, where seasoned timber is scarce. Under any circumstances the transportation of instruments and its supports, in a wild country, is troublesome and expensive. The zenith telescope is generally heavier than the astronomical transit need be; its principal advantage over the latter consists in the less amount of calculation necessary. But in running a parallel much of the calculation can be done beforehand—especially for the transit.

The things necessary in thoroughly good boundary work, are a skilled observer and calculator to take the zeniths and observe latitudes where required, a competent engineer to run the lines, especially where the country is difficult, and instruments of firm and solid construction, which do not easily get out of order. A meridian line can be checked by longitude determinations; the Land Office requires them to be made by telegraph, where possible.

In a future article I will give an account of the purely astronomical operations of determining latitude and longitude.

COAL IN THE UNITED STATES.—The production of anthracite coal in the United States is now estimated at 19,000,000 tons per annum. The production has generally doubled every ten years, so that by 1884 it is expected that it will uot fall far short of 40,000,000 tons per annum.

Popular Science Notes.

THERMOMETERS.—There are two liquids in use for the construction of Thermometers—mercury and spirits of wine. Each has its peculiar advantages. Mercury can withstand a very high temperature, and spirits of wine a very low temperature. The latter cannot be frozen. Neither of them, however, can measure the gradations of furnace heat. This is generally done by a bar of platinum, the most valuable metal in existance, and the least fusible by heat. Its expansion by heat, and contraction by cold, affords the means of ascertaining the relative power of the most intense furnace. Such an instrument is called a pyrometer. There are several different thermometrical scales used throughout Europe, which causes considerable confusion and unprofitable trouble in the scientific world. Our own scale is that of Fahrenheit, a Dutch merchant, in which the freezing point is 32°, and the boiling of water 212°. The centigrade is used in France—freezing point 0, boiling point 100. Reamur has the boiling point 80. De Lisle's is a descending scale, boiling point, zero, or nothing. This is in use in Russia. This all produces the same effect as a difference of language, in causing a separation between the scientific pursuits of different nations, and preventing that free and social intercourse, without which illiterate and limited views of all subjects must, to a certain extent, possess the minds of nations and individuals.

FROSTING GLASS.—Dissolve 1 oz. of epsom salts in water; add a little gum-arabic; brush this over your glass, and let it dry.

LEAD CEMENT.—Add red lead to white lead till you have it the consistency of putty; the sooner you use it the better. It will become as hard as a stone.

PLATINUM.—The fusing point of platium, according to Pouillet, is 3082° Fahrenheit—others 3600°.

APPARENT SIZE OF THE MOON.—The principal cause of the enlarged appearance of the moon, at rising and setting, is its being seen near to or in connection with terrestrial objects; the magnitude of these being more or less familiar to us, the space the orb covers seems large by comparison. The more distant the object the more conspicuous does the apparent size of the moon become; but having attained any considerable altitude, being out of the line of vision, it is consequently unaffected in its appearance by contrast with distant objects.

MEASURING STANDING TIMBER.—Take the quarter circumference of a tree at six feet from the ground, multiply its square in inches by the length of the tree in feet, then divide by 144, and the result is cubic feet in the tree.

VARNISH FOR MAPS.—Pure Canada balsam, 4 oz., camphine 8 oz.; warm gently and shake together till dissolved. Before using, the map must be brushed over with a solution of isinglass.

REMOVING INK STAINS FROM MAHOGANY.—Put a few drops of spirits of nitre in a teaspoonful of water; touch the spots with a feather dipped in the mixture; and on the ink disappearing rule it over immediately with a rag wetted in cold water, or there will be a white mark which will not be easily effaced.

GARDEN WALKS.—Fine shingle 6 parts, sand 1 part, and Portland cement 1 part, make an imperishable imitation of a gravel path. It is cast in short

lengths on the ground, and the "fat" washed off the top before it is quite set, with a hair broom.

GUN METAL.—English gun-metal is an alloy of 90 parts copper and 10 parts of tin. Its fusing point is 1900° Fah.

TO REMOVE SCALES FROM BOILERS.—Crude petroleum will remove scales from boilers. The *Titusville Herald* describes an experiment upon an 80-horsepower boiler, with the most satisfactory results. After the boiler had been blown off, ten gallons of crude oil was introduced, and as the water gradually rose the oil floated on the top and coated the scale, both in the interior shell of the boiler and on the flues. At the expiration of three days the water was again blown off, and a large quantity o scale with it. Another ten gallons of oil was admitted and the same operation gone through for three days, and the water was again blown off. The manhole was again uncovered and the interior carefully examined. The scale had almost entirely disappeared and what remained was quite soft and easily taken off The boiler is now as clean and smooth on the inside as the day it was put up, and a very small amount of crude oil is found to prevent the accumulation of any deposits.

PRESSURE OF WATER.—Multiply the square of the diameter in inches by the length in feet, and that by .054; then multiply that product by 10, that being the number of lbs. in one gallon. The result is weight in pounds.

Another Rule. Area of pipe × height of pipe × weight of water. Sea water weighs .0372 lb. per cubic inch, and distilled water .03617.

JOINING IRON AND WOOD.—Glue, to which one-eighth of strong acetic acid has been added, will make a pretty strong joint between iron and wood, provided the surfaces be both tolerably smooth.

Notes on Landscape Gardening.

WHAT IT IS.

Landscape Gardening is an artistical combination of the beautiful in nature and art—an union of natural expression and harmonious cultivation—capable of affording us the highest and most intellectual enjoyment to be found in any cares or pleasures belonging to the soil.—*Downing.*

The development of the Beautiful is the end and aim of Landscape Gardening.—*Ibid.*

This embellishment of nature, which we call Landscape Gardening, springs naturally from a love of country life, an attachment to a certain spot, and a desire to render that place attractive.—*Ibid.*

Landscape Gardening is a modern word, first coined by Shenstone.—*Ibid.*

WHAT A LANDSCAPE GARDENER IS.

A Landscape Gardener should be a person not only gifted by nature with the love of all that is beautiful, but culture and education should have refined his taste, and improved his powers of judgment; while a knowledge of the habits of polished life, to be acquired only by an admittance into the best society, must have taught him to combine a thousand little nameless circumstances that are necessary to perfection in his art.—*Repton.*

Though a painter may represent a beautiful landscape on his canvas, and even surpass Nature by the combination of her choicest materials, yet the luxuriant imagination of the *painter* must be subjected to the *gardener's* practical knowledge in planting, digging and moving earth; that the simplest and readiest means of accomplishing each design may be suggested. On the other hand, the mere gardener, without some skill in painting, will seldom be able to *form a just idea of effects before they are carried into execution.*

The Landscape Gardener must therefore possess the faculty of *foreknowing effects.—Ibid.*

He must also possess a competent knowledge of *surveying, mechanics, hydraulics, agriculture, botany,* and the general principles of *architecture.—Ibid.*

NEW PUBLICATIONS.

CONTINUOUS REVOLVING DRAWBRIDGES. The principles of their construction and the calculation of the strains in them. With more especial reference to the designing of continuous PANEL girders of this description. By Clemens Herschel, C. E., Member of the American Society of Civil Engineers. With 19 wood cuts and 10 Heliotype Plates. Boston: Little, Brown & Co., 1875.

When the revolving or pivot draw-bridge first came into use, it was customary to calculate the strain on the different members of the truss as if, when open, it were composed of two cantilevers or beams fixed at one end, and when closed, as a truss of the entire span, simply supported at its ends. To realize this latter condition it would be necessary to raise the ends so high that no pressure should come upon the centre of the pier, even under the heaviest loads; and if ever attempted, it was never successfully accomplished,

Within comparativeiy a few years the cases of girders continuous over two or more spans have been analyzed, and, while few such structures have been erected in America. they are comparatively numerous abroad. The treatment of a continuous draw-bridge would seem to fall under this analysis, but we are again met by an obstacle in the fact that the end supports are seldom or never on an exact line with the center support, and that the slight difference of the level which exists has a very marked influence upon the strains in the several parts of the truss.

Those engineers who have had occasion to make a design for a draw span of this class are well aware of the need of a book which would give a theory for a drawbridge, agreeing well with all the conditions under which the structure worked. Mr. Clemens Herschel has offered to the profession a small book, a reprint of a paper submitted to the American Society of Civil Engineers, in which he handles this difficult subject in a very satisfactory manner. His classification of the different cases likely to arise is excellent, and can readily be followed. Any one who has attempted an investigation of continuous girders must be well aware that such subjects cannot be made very *easy*, but no engineer who is at all conversant with the usual method of analysis for a beam under a flexure ought to have much difficulty in accompanying our author. We should have preferred that, to enable some to start with a clear understanding of the premises, Mr. Herschel had given us some of the equations preceding (17), instead of starting with four general equations from the German author, Weyrauch. However, any earnest investigator can assure himself of the truth of these formulæ.

The author's division of the load into certain parts in determining the reactions of the supports, is very neat, as is also his treatment of the supporting force exerted by the circular girder and pivot. His suggestion of weighing the reactions, in order to bring them to the exact amount determined in the analysis, seems to be entirely practicable, although, in a continuous girder of many spans, it might call for a number of sets of weighing apparatus.

Part I. contains the line of reasoning; Part II, the mathematical work: and Part III, a numerical example. A valuable list of German, French, and English authors who have written on the Continuous Girder is appended to the book.

While the supposed conditions under which a structure is designed, are never precisely realized in practice, and, consequently, the theoretical strain may be more or less departed from, a careful investigation which shall agree as nearly as possible with the facts is always needed. This book supplies such a need, and ought to enable many to get a clear idea of the correct method of treatment in designing a revolving draw-bridge.

The book is printed on excellent paper, is neatly and substantially bound, is unexcelled in typographical appearance, and in its entire mechanical execution is most creditable to its publishers,

Graphical Method for the analysis of Bridge Trusses; extended to Continuous Girders and Draw Spans, By CHAS. E. GREENE, A. M., Prof. of Civil Engineering, University of Michigan. Illustrated by three folding plates. D. VAN NOSTRAND, New York, 1875.

The mathematical language and formulæ of Scientific Treatises on bridge construction deter many of the self-educated Engineers of this country from their study,

What knowledge they may have of this branch of Engineering has been "picked up" in the course of practice, and is generally as limited in amount as it is deficient in certainty. Even the best of Engineers, in the all absorbing pursuit of their regular professional labors, lose their interest in the intricate mathematical investigations with which they were fa niliar, and will at once close a book that presents a formidable array of formulæ and demonstrations requiring them to "post up" in the studies that have for years been neglected and unused. To both of these classes must this work of Prof. Greeene's prove a welcome assistant. A half hour's study by the latter class will recall the needed mathematical knowledge, and its practical application is then a simple matter. To the former class—the young Engineers—whether from a school of Engineering or not—to those who have heretofore taken little interest in the subject, to surveyors who are aspiring to something higher than land measuring, and to architects, this book is earnestly recommended,

Starting from a simple fundamental theorem of mechanics—the triangle of forces—and applying it graphically—that is by diagrams, easily put on paper and for which all the instruments needed are, a good drawing board, triangles, T-square, scale and lead pencil—to single span trusses, with horizontal chords, the student is led easily and rapidly to the more complicated examples of bridge construction, ending with that of Pivot-bridges or draw spans, becoming at the same time familiar with the terms and meaning of the phraseology in common use in this class of structures.

Prof. Greene has conferred a real benefit on the profession, in placing the results of his studies on

this subject before them in so plain and practical a manner, and in clearing away much of the mystery and a large share of the difficulties that surround the subject of his treatise.

CATECHISM OF THE LOCOMOTIVE, by M. N. Forney, Mechanical Engineer. Published by the Railroad Gazette, 73 Broadway, N. Y., 1875.

This very useful work is written more especially for the information of locomotive runners, firemen, and the many different kinds of mechanics employed in railroad shops, and in the construction of locomotives and other kinds of railroad machinery and material. There are, however, large number of persons who are interested in practical mechanism, and to whom a visit to a cotton mill or a machine shop is fraught with the greatest delight. Who of such persons are there but love to look upon that most beautiful and lifelike machine, the railway locomotive, and having seen it at rest and in motion, but would love to know something of its construction and its capabilities? To all such "amateurs," as we may term them, "The Catechism of the Locomotive" is recommended. Simple in style, and entering into the most minute details of the construction, operating, and repairing of locomotives, and profuse of illustration, it seems as if it had exhausted the subject, and left little more, if anything, to be told. The book contains 625 pp., of 4½×7 inches, and about 250 wood engravings, and is really one of the most valuable acquisitions to railroad literature that has yet appeared.

CORRESPONDENCE.

The Centre of a Section.

MISCONSTRUCTION OF THE U. S. LAWS.

SHAWANO, WIS, March 24, 1875.

MR. EDITOR:—In my opinion your correspondent, J. Van B., of Tipton, Ind., in his statement on pages 33 and 34, No. 3, Vol. 2, has evidently misconstrued the intention of the U. S. Law of Feb. 11, 1805, in applying it to the establishment of a centre quarter corner of a section.

That portion of the law in question reads as follows:—"And the corners of half and quarter sections, not marked on *said surveys*, shall be placed as near as possible equidistant from the corners which stand on the same line."

The law is explicit, and refers to "*said* surveys," i. e., the lines which have been surveyed and recorded, and as the half section lines (or in other words the quarter section lines) were *not* surveyed by the Government, therefore it is plain that it has no reference to the establishment of the *north* half section or *north* quarter section corners (synonymous terms) of the *north* tier of sections upon township lines, in cases where there are *double* section corners; and there are many townships thus subdivided in this county, (Shawano), and in *no* cases where there are *double* corners, has there been *north half* section or *north* quarter section corners established by the Government for the *north* tier of sections in this county.

I will here remark that the same misconstruction of the U. S. Laws was made by the Wisconsin Legislature of 1862, as is evident by the passage of an Act requiring surveyors to establish the centre of a section at a point *equidistant* from the quarter corners, precisely as described by J. Van B., of Ind.

Subsequently it was discovered that this State law was in direct conflict with the Act of Congress of Feb'y 11, 1805, which requires the centre quarter post of a section to be set at the *point* of *intersection* of *straight* quarter lines; and it was therefore null and void and inoperative, and in consequence was repealed in 1867. Surveyors of this State are now governed only by the U. S. Law.

The said "more than useless" State law cost the land owners of the State of Wisconsin many thousands of dollars, and it was strictly observed by most of the surveyors throughout the State, thus necessitating the re-subdivision of hundreds of sections, and the removal of division fences and buildings, at an enormous expense.

The Records of this county show that a difference of 182 links exists between the position of the two centre posts of section 18, T. 26, R. 15 E., 4 P. M., as set by the two different methods.

All sections in this County and State, which have been improperly subdivided by the said State law are being rapidly re-subdivided according to the U. S. law governing the same.

The *largest* subdivisions of a section contemplated by the U. S. Laws are *half* sections.

In subdividing a section into *half* sections, I run a *straight* half section line from the properly identified or established *half* section corners, east and west, or north and south, and the *point* of *intersection* of these *straight half section lines* is the legal centre of a section.

My experience teaches me that the "equal area system" is impracticable in strictly legal surveys, made according to the U. S. Laws governing the same.

I consider the above a fair and proper explanation of that portion of the U. S. Laws referred to, and should any practical surveyor differ in opinion from me, let him "speak out" for the benefit of the profession, and thus help to establish a lawful and uniform method for the subdivision of sections U. S. surveys throughout the United States.

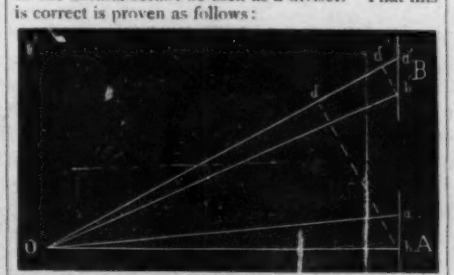
J. M., County Surveyor.

Stadia Measurements.

LOUISIANA, MO., March 24, 1875.

MR. EDITOR:—"Honor to whom honor," &c. I cannot let pass the opportunity of giving due credit to your paper, and as I realize that it is a valuable medium for the interchange of information, I wish to contribute my mite. I have been much interested by the full discussion of the "telemeter" in your columns. After a few trials, I succeeded in putting in a pair of cross-hairs in a level, on the ordinary diaphragm, which subtended 1.00 ft. at a distance of 100 ft. Any one of my brother engineers can do the same, and will find themselves very well paid for their trouble. A few trials satisfied me that the correction as given by Mr. French, in the January "NEWS," was not correct, and I set about deducing a formula for the same, which should apply and correspond to the actual results I obtained. I was forestalled in my intention of sending this formula to you by the appearance of the formula of Mr. Dall in the Feb'y "NEWS." I found his formula to correspond with my own, and would suggest a little clearer notation only, in order to make the formula perfect. With the telemeter hairs in a level as above described, I have recently run some 20 miles of levels at a rate, in open ground, of a mile in an hour, and with a party of two men only—one rodman, and one to keep notes.

I would suggest as a substitute for the "Table of Divisors," in the March "NEWS," that a multiplication by the square of the natural cosine of the angle of elevation be used, or that its equivalent, the square of the natural secant be used as a divisor. That this is correct is proven as follows:



Let O b be a horizontal line to the rod at A, and let b O b' be the angle of elevation of the sight to the rod at B.

Let d b and d'b' be perpendicular to O b'. Then angle b O b'—d b b'—d'b'a'. The rod reading a'b' multiplied by cos. d'b'a'(—cos. b O b')—d'b' which is the true reading for distance O b'—; but O b' : O b :: 1 : cos. b O b' ∴ O b—O b' × cos. angle bO b' ∴ a'b' × cos.² b O b'—a b or a'b' ÷ sec.² b O b'—a b, or in general, if δ —the angle of elevation, the true reading for giving the horizontal distance will be found by multiplying by cos.² δ or dividing by sec.² δ.

Very truly, &c., H. W. P.

The Real Estate and Building Journal, of this city, published at 91 and 93 E. Washington street, has recently made some very important changes in its form, contents and subscription price. It now gives a weekly record of *all* the transfers of property under any and every form of conveyance that is recorded: gives also a list of judgments rendered in the city courts, list of mechanic liens, advertised legal sales, building permits, and everything else that relates to land ownership and house building in this city and county. Its list of records covers 16 pages of same size as this journal, and we feel assured must prove of great value to the large class of land owners, and dealers, and builders, for whose benefit it is prepared. The price is two dollars per annum, the same as its New York contemporary. We hope the enterprise of our old friend Hungerford will be well rewarded.

The April number of the *American Engineer* published in Baltimore comes to us this month enlarged from twelve to sixteen pages and otherwise improved. It is the only illustrated mechanical journal published south of New York, and judging from its numerous advertising columns is appreciated by the class to whom it is addressed, as a valuable medium through which to make known their wants or wares. The subscription price is only ane dollar.

THE method of electing the President of the French Academy of Sciences is very peculiar. In the beginning of January each year a member is nominated Vice-president for the year, and becomes President the following year without being re-elected. The appointment is made alternately in the classes of Physical Science and Mathematics. It being the turn this year of the latter section, Admiral Paris has been elected Vice-president and will be President in 1876. The President actually in office is M. Fremy, the celebrated chemist. M. Paris was born at Brest in 1806, and his first voyage was on board the *Astrulabe*, in which he circumnavigated the globe, under Dumont d'Urville, in 1826. He lost his left hand at Pondicherry in 1837, when visiting a factory. He was created an admiral in 1858.

Law and Legislation.

An abstract of decisions of the Supreme Court of the United States and of the courts of the various States in the Union upon questions relating to boundaries, surveys, etc. Compiled for the ENGINEERING NEWS by John Dunn, Esq., Attorney at law.

238. The law cannot determine whether the courses or distances shall govern in cases where the ascertaining of the boundaries of land are in question, where such courses or distances do not correspond, but that must be settled by concurring testimony, and the circumstances of each particular case. *Ibid.*

239. Where, as in a patent from the United States, the land is only described in the conveyance by numbers and quarters, the Court will look at the plats and field notes of the public surveys, in order to locate the land, and these are considered as part of the patent itself. Field notes must yield to actual monuments erected by the original surveyor, and are only to be relied on as evidence to assist in ascertaining the exact situation of the monuments. *Ibid.*

240. Wild lands are bounded by such lines as have been run by a proper authority at the time of purchase, if any; and if none, by those which are afterwards so run. Buel's Lessel v. Tuley. 4 McLean (U. S.), 268.

241. In the boundary of wild lands, marked lines and corners control the courses and distances laid down in a patent. Robinson's Lessel v. McLean (U. S.), 279.

242. The mere acquiescence in a line, as a dividing line between adjoining proprietors, for fifteen years, although but one of the proprietors, and perhaps neither, is in actual possession, is sufficient to establish that line as the true line of division, if known and claimed by both proprietors, Brown v. Edson, 23 Vt.. 435.

243. The declarations of deceased persons who from their situation appear to have had the means of knowledge respecting boundaries, and who had no interest to misrepresent the facts, are admissible in evidence. Great Falls Co. v. Worster. 15 N. H.. 412.

244. Where land is conveyed "beginning at" and bounding on land of "B," the point of beginning and boundary is the true line of B's land, and not the line of B's occupation as shown by a fence set up and maintained by B before and after the conveyance, with the consent of the owner of the lot conveyed, under the mistaken belief that such was the true line. Cleaveland v. Flagg, 4 Cushing (Mass.), 76.

245. A grant by the legislature to numerous individuals, authorizing them to fill up in front of their lands the land under the water of a river or bay to a fixed exterior line, is a grant to each of the shore proprietors in severalty of such right to the extent of the land under water in front of his own shore. O'Donnel v. Kelsey, 4 Sandf., Sup. Ct. (N.Y.), 202.

246. The owner of a village lot bounded by a street is *prima facie* the owner to the center of the street. Adams v. Rivers, 11 Barb. Sup. Ct. (N. Y.), 390.

247. Where the owner of real estate in a village lay out a street through the same, and divides the land on each side of it into village lots, which he to individuals in fee, commencing his boundary at a stake in the line of the highway, but not including the highway in express terms, the respective owners take to the centre of the highway. Adams v Saratoga and Washington R. R. Co., Barb. Sup. Ct. (N. Y.) 414.

248. The grantee of a lot bounded on a public street, *prima facie*, takes to the centre of the street. To prevent the grant having this effect, there must be language expressly including the street. *Ib.*

249. Where the question is as to the actual location of a way, as a boundary, the proceedings of the surveyors of the way are admissible in evidence without proving the appointment of the surveyors. Horing v. Van Houten, 2 New Jersey, 61.

250. Where a witness had been surveyor of the county (where land claimed was situated), for sixteen years, and assistant of the county surveyor for many years previous, and testified the beginning tree of a tract of land could not be found, that he had never heard of it, and had found the beginning by reversing the course and distance of the patent from another boundary, this was held sufficient evidence of an endeavor on the part of the party seeking to establish the lost beginning, by finding the position of the same. Wilson v. Intoes 6, Gill (Md.), 121.

251. The jury is the proper tribunal to decide whether any and what variation ought to be allowed in the location of land. *Id.*

252. Where land was described in a conveyance as bounded adjoining lots and by a street, and the quantity of ground within these bonnds exceeded by twelve feet the measurement contained in the conveyance, it was held that the boundaries governed. Petts v. Gaw. 15 Penn., State Rep. 218.

253. The marks on the ground of an old survey, indicating the lines originally run, are the best evidence of the location of the survey, and if any evidence of such lines exist, it should be referred to the jury. Gratz v. Hoover, 16 Penn. State Rep., 232.

254. Course and distance must yield to natural and artificial objects of description. Gaveny v. Hinton, 2 Greene (Iowa), 344.

Practical Mathema tics

PLANE TRIGONOMETRY.

TO FIND THE DISTANCE OF THE SEA HORIZON IN MILES.—Let h be the height of the eye above the sea, expressed in feet.

$$(\text{distance})^2 = 1.5h.$$

Hence, the following rule for finding the distance of the sea horizon in statute miles:—

RULE.—To the height of the eye in feet add half the height, and extract the square root of the sum; the result will be the distance in statute miles.

TO FIND THE DIP OF THE HORIZON.—The dip or depression of the horizon is the angle between the tangent to the earth's surface, and the horizontal line drawn through the eye; it is evidently equal to the angle at the centre subtended by the tangent t, or the distance of the sea horizon. It is easy to calculate from the expression for this distance, that the

$$\text{Dip of the horizon in minutes} = 1.06\sqrt{h}.$$

In consequence of the refraction of the rays of light by the earth's atmosphere, the dip is somewhat less than this. The following rule will always serve in practice for calculating the dip:—

RULE.—The square root of the height expressed in feet is equal to the dip expressed in minutes.

QUESTION.—A gentleman has an elliptical garden, the principal axes of which are 50 and 40 yards, enclosed by a brickwall 23 feet high. He ordered his gardener to place his seat at equal distances from the center, one of the foci, and the boundary of the garden, and around the seat to make a gravel walk of equal breadth, taking up 1-20 of the area of the garden, and to be of such nature, that, while the gentleman is seated, and the gardener moving along the middle of the walk, the gentleman's eye, the gardener's utmost height, and the top of the wall, may be in the same right line; the height of the gentleman's eye, (when seated), and that of the gardener, being 4 and 6 feet respectively. Required, the position of the seat, and the nature and breadth of the walks.

SOLUTION.—The following is the answer to question in your last issue:

The horse will travel in a spiral path; the distance around the first time will be 625,178 yds., which is obtained by calculating the circumference of a circle of 99½ yds., radius. The last time around the diam eter will be 1 yrd., and the circumference 3.1416. We now have given the first and last terms and number of terms to find the sum of all the terms.

$625.178 + 3.1416 = 628.3196 : 2 = 314.1598 \times 100 = 31416.98$ yds. answer W. A. T.

Court Partitions.

Land which is to be partitioned by order of a court, is usually subdivided into tracts or "lots," which are described by "metes and bounds." This method may do very well in the case of irregular pieces of ground, where a survey has been made and the exact measurement of all the boundaries and angles are known. But in the public land States, where the tracts to be divided are parts of a section, it should never be done.

The commissioners appointed by the court to partition the land assume the government dimensions as correct, and divide the land accordingly. In actual practice, however, these dimensions seldom agree with the records, and the consequence is that after the several parcels or lots of land have been described and conveyed, there is a small strip either of "surplus" or "deficiency," which is only discovered when the last lot described is surveyed. Each lot is located by "metes and bounds," and where that exact location is, depends on the accuracy of each surveyor's chain, and of his chaining. There is no such thing as dividing *pro rata* among the deeds, either the surplus or deficiency, as the order to the surveyor is peremtory, and he has no choice. Thus, after a lapse of time questions arise, and litigation creeps in.

The proper method is always to divide the tract proportionately, whether a survey is made previous to the partition or not, and number each fraction as a lot; surveyors would then divide *pro rata*, and all differences would be absolutely eliminated.

THE REAL ESTATE UNIT.—A "lot" 25 feet front by 125 feet deep, to 66 feet streets and a 14 feet alley, is the "Unit" of the Western Real Estate Dealers. and when it is said that lots in a certain subdivision are worth so and so, the above dimensions are understood, unless others are definitely stated.